Chromalox®
PRECISION HEAT AND CONTROL

microTHERM™
CMX Series

microTHERM™

Circulating Water Temperature Controller

System Model Number and Rating _____

Part Number _____ Serial Number _____

Customer _____

Customer Order Number _____ Date _____

User's Manual
Part Number: 161-123417-023
Sales PQ445-5

Issue Date
January 2012

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Section 1
Getting Started

Section Contents

- Introduction
- System Photo
- Model Identification

Important

Read and understand all instructions in this user's manual and the enclosed 2104 temperature control instruction manual before attempting to install or operate system.

Introduction

Congratulations on purchasing the Chromalox CMX Series microTHERM™ Temperature Control System. This system has been thoroughly engineered, carefully built, and fully tested to assure years of service.

The CMX can be operated at a maximum temperature of 250°F at a minimum pressure of 30psi. CMX-180 models do not require minimum pressure. Water temperature is maintained by a microprocessor-based temperature controller which applies heating and cooling as needed. Heat is applied by a long-life, Incoloy®sheathed heater. Cooling is either via direct injection, in an open loop, or through a closed loop heat exchanger.

Every system is equiped with an automatic vent that removes unwanted air from the system during operation, and an ASME pressure relief valve that is factory-set to 125 psi (150 psi with 7.5 hp motor.) A pressure switch ensures adequate water pressure in the system to help prevent pump cavitation and steam buildup on the heater elements, which can shorten the lives of the heater and pump. The switch is factory-set to 20 psi. This switch is not included on CMX-180 models.

Electrical and hydraulic components are located in distinctly separate areas in the system to better manage heat buildup and prevent component damage. The pump housing, heater, and cooling chambers are single cast pieces, designed to drastically reduce the chance of leaks and provide ease of service and maintenance. Standard casters make it easy to move the system from machine to machine.

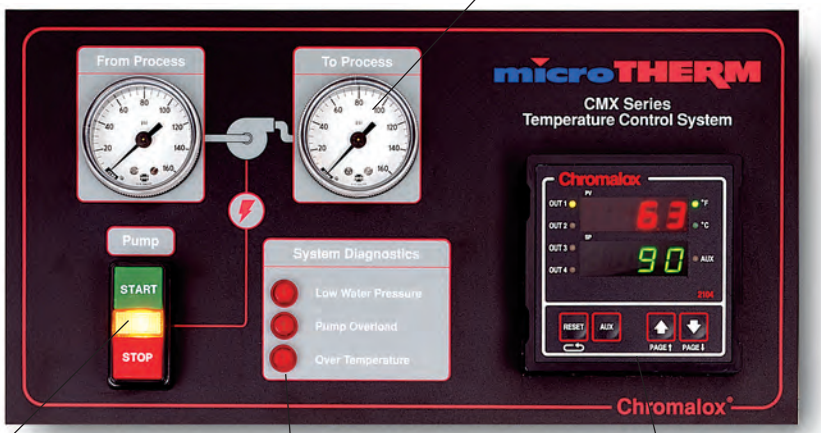
Power requirements for the system are 240 or 480 volts, 3 phase, 60 cycle, and 4.5 to 24 kW. See the system nameplate for the appropriate voltage and wattage ratings.

The System Photo and Control Panel Illustrations, on the following pages, show the CMX and identifies all key components.

Figure 1.1
System Photo

Operating temperatures of 50° to 250°F for a wide variety of applications
ASME pressure relief valve opens if system pressure exceeds 125 psi, ensuring safe operation
Incoloy® sheath Chromalox® heating elements.
Integral solenoid valve for precise temperature control and optimum flow.
Automatic air purge cycle removes accumulated air from water lines.
Standard 3.8 sq. ft. heat exchanger (closed loop cooling)
Cabinet design allows access to all components without removing a single fastener.
Compact, rugged cabinet fits into tight spaces. Rolling casters allow easy transfer between locations.
Low pressure switch disables system when supply pressure is low, preventing cavitation in pump and protecting the system. (Not provided on CMX-180 models)
Custom cast pump for optimum flow, minimum leakage and long life.

Figure 1.2
Control Panel



Dual pressure gauges for monitoring of both *to process* and *from process pressures.*

Pump START/STOP Pushbuttons

Diagnostic Indicators

Chromalox's 2104 Temperature and Process Controller

Ordering Information

Model	KW	Volts	Total Amperage
Open-Loop Cooling			
CMX-250-4	4.5	240	13.6
CMX-250-4	4.5	480	6.8
CMX-250-9	9	240	24.5
CMX-250-9	9	480	12.2
CMX-250-12	12	240	31.7
CMX-250-12	12	480	15.8
CMX-250-18	18	240	46.1
CMX-250-18	18	480	23.1
CMX-250-24	24	240	60.5
CMX-250-24	24	480	30.3
Closed-Loop Cooling			
CMX-250-4C	4.5	240	13.6
CMX-250-4C	4.5	480	6.8
CMX-250-9C	9	240	24.5
CMX-250-9C	9	480	12.2
CMX-250-12C	12	240	31.7
CMX-250-12C	12	480	15.8
CMX-250-18C	18	240	46.1
CMX-250-18C	18	480	23.1
CMX-250-24C	24	240	60.5
CMX-250-24C	24	480	30.3

• All voltages are 3 phase. 120V control transformer provided with each unit for control power.
-C: Suffix indicates 3.8 sq. ft. heat exchanger for cooling. All systems equipped with 30 GPM 20 psi. TDH pump standard. Optional Pump flows up to 80 GPM and 70 psi. TDH available.
• For low pressure applications - “250” in the model number is replaced by - “180”. Pressure switch is not provided.

Section 2
Installation

Section Contents

- Hydraulic Installation Open-Loop Cooling
- Hydraulic Installation Closed-Loop Cooling
- Electrical Installation

Before Open-Loop Hydraulic Installation

Before proceeding with the installation of the open-loop system, please take note of the following important information:

1. Reduced diameter fittings may be used if they do not reduce flow rate and increase pressure drop significantly. Galvanized steel unions are recommended at all connections.

2. If water pressure falls below 20 psi, a pressure switch will interrupt pump motor and heater operation. Use an external water pressure regulator and back pressure relief valve or regulator, set at maximum 125 psi (150 psi with 7.5 hp motor) connected in the external fill line, to reduce excessive water pressure. Not provided on CMX-180 models.

⚠ WARNING

Hazard of Explosion, Fire and Scalding Burns

1. The water feed line on both open and closed loop systems must not have any obstructions which could prevent expanding water from backing up into the feed line.

2. Do not use oils or other synthetic heat transfer fluids. This system is for use with water or ethylene glycol and water mixture for freeze protection only as the heat transfer fluid.

3. When installing system, allow sufficient room to remove the heater element and other serviceable items when necessary. 18 inches clearance on sides of unit recommended.

4. If the water source is a potable water source, a back flow preventer and back pressure relief valve/regulator should be installed and may be required by local code. Do not install a check valve only on the fill line. The inability of the system to flow back into the fill line can lead to excessive pressure. Back pressure relief is required.

5. To avoid excessive pressures, do not connect any valves or obstructions which could prevent free discharge from relief valve in a safe manner. Route line so water drains completly. Do not allow drain to freeze or corrode shut.

Hydraulic Installation Open-Loop

1. Locate the unit as close as possible to the controlled process in order to minimize pressure drops. Make sure the unit is sitting on a solid, level foundation.

2. Using 1 1/4" NPT or larger schedule 40 pipe (flexible hose suitable for 150 psi and 250°F minimum service conditions can be used), connect the 1 1/4" NPT "FROM PROCESS" and "TO PROCESS" ports to the mold, mold manifold, or other process.

3. Pipe the entire system to minimize air pockets. Provide air bleed valves at high points and drains at low points.

4. Connect the plant water supply (30 psi to 80 psi) to the unit's 1/2" NPT "WATER SUPPLY/COOLING INLET" port with suitable pipe or hose.

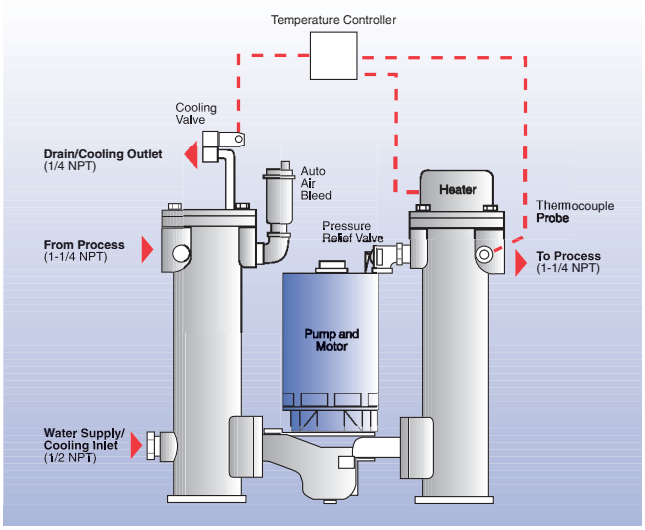
⚠ WARNING

Hazard of Explosion, Fire and Scalding Burns

5. Connect the 1/4" NPT port identified as "DRAIN COOLING OUTLET" to an open or plant drain that contains no valves or obstructions that could impede discharge. Review the condition of potential hot water or steam going down a plant drain. Verify that local codes and materials are acceptable for this service.

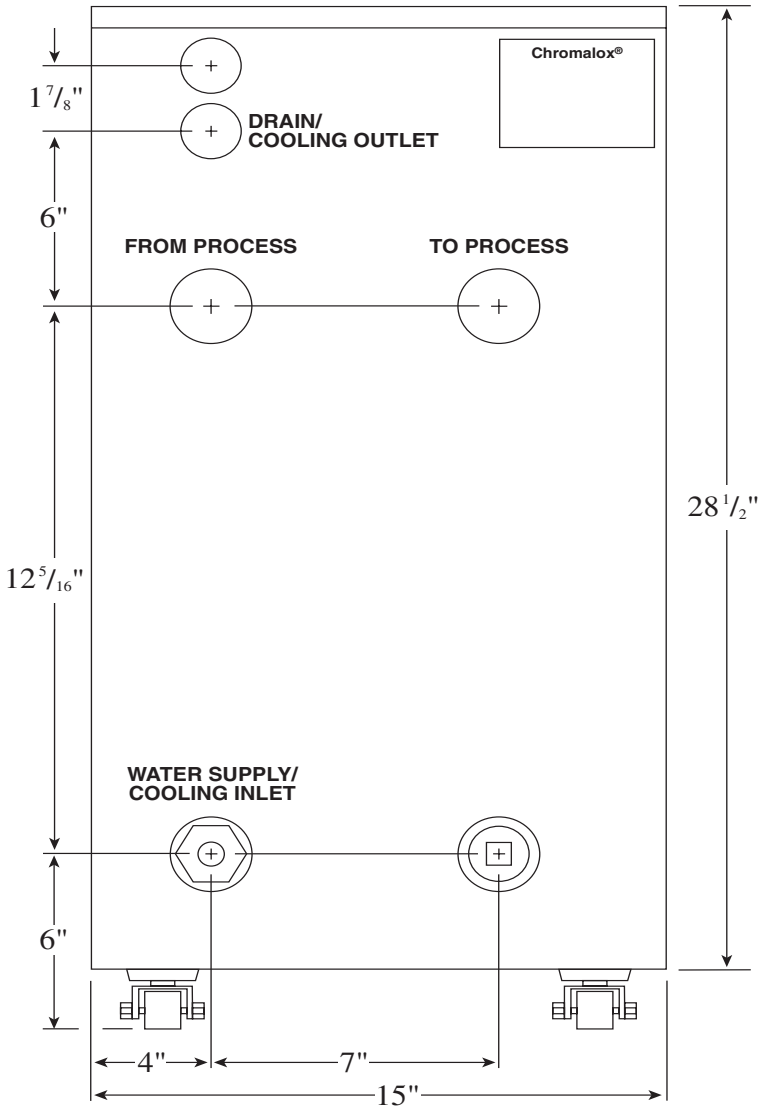
6. Locate floor drain under unit. The air bleed and relief valve may discharge hot water or steam from the bottom of the unit. Do not locate materials that could be damaged by hot water or steam adjacent to the unit.

Figure 2.1
Open-Loop System Piping



Open Loop Cooling

Figure 2.2
Open-Loop Cooling
Piping Connections



Rear View

Note: Dimensions are nominal ± 3/8"

Before Closed-Loop Hydraulic Installation

Before proceeding with the installation of the Closed-loop system, please take note of the following information:

1. Reduced diameter fittings may be used if they do not reduce flow rate and increase pressure drop significantly. Galvanized steel unions are recommended at all connections.

2. If water pressure falls below 20 psi, a pressure switch will interrupt pump motor and heater operation. Use an external water pressure regulator and back pressure relief valve or regulator set at maximum 125 psi (150 psi with 7.5 hp motor) connected in the external fill line, to reduce excessive water pressure. Not provided with CMX-180 models.

⚠ WARNING

Hazard of Explosion, Fire and Scalding Burns

1. To avoid excessive pressures, do not connect any valves or obstructions which could prevent free discharge from relief valve in a safe manner. Route line so water drains completly. Do not allow drain to freeze or corrode shut.

2. Do not install a check valve on the fill line. The inability of the system to flow back into the fill line can lead to excessive pressure. If back flow preventer or check valve is required, install back pressure regulator rated for 250°F water with a pressure setting of 30 to 80 psi. Back pressure regulator setting must be approximately 10 psi above water supply pressure to minimize water flow directly from supply to drain.

Hydraulic Installation Closed-Loop

1. Locate the unit as close as possible to the controlled process in order to minimize pressure drops. Make sure the unit is sitting on a solid, level foundation.

2. Using 1 1/4" NPT or larger schedule 40 pipe (flexible hose suitable for 150 psi and 250°F minimum service conditions can be used), connect the 1 1/4" NPT "FROM PROCESS" and "TO PROCESS" ports to the mold, mold manifold, or other process.

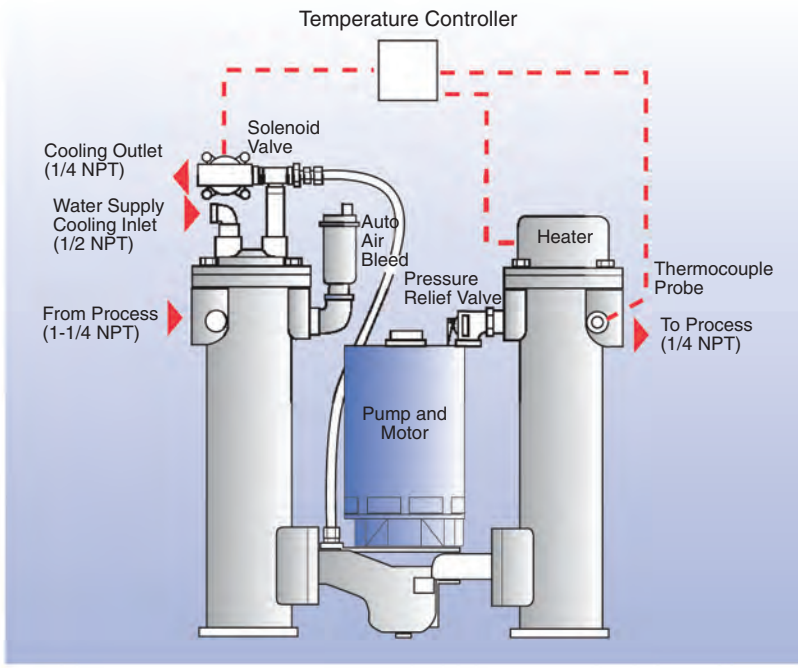
3. Pipe the entire system to minimize air pockets. Provide air bleed valves at high points and drains at low points.

Hydraulic Installation Closed-Loop
(continued)

4. Connect the cooling water supply (30 psi to 80 psi) to the unit's 1/2" NPT "WATER SUPPLY/COOLING INLET" port with suitable pipe or hose.

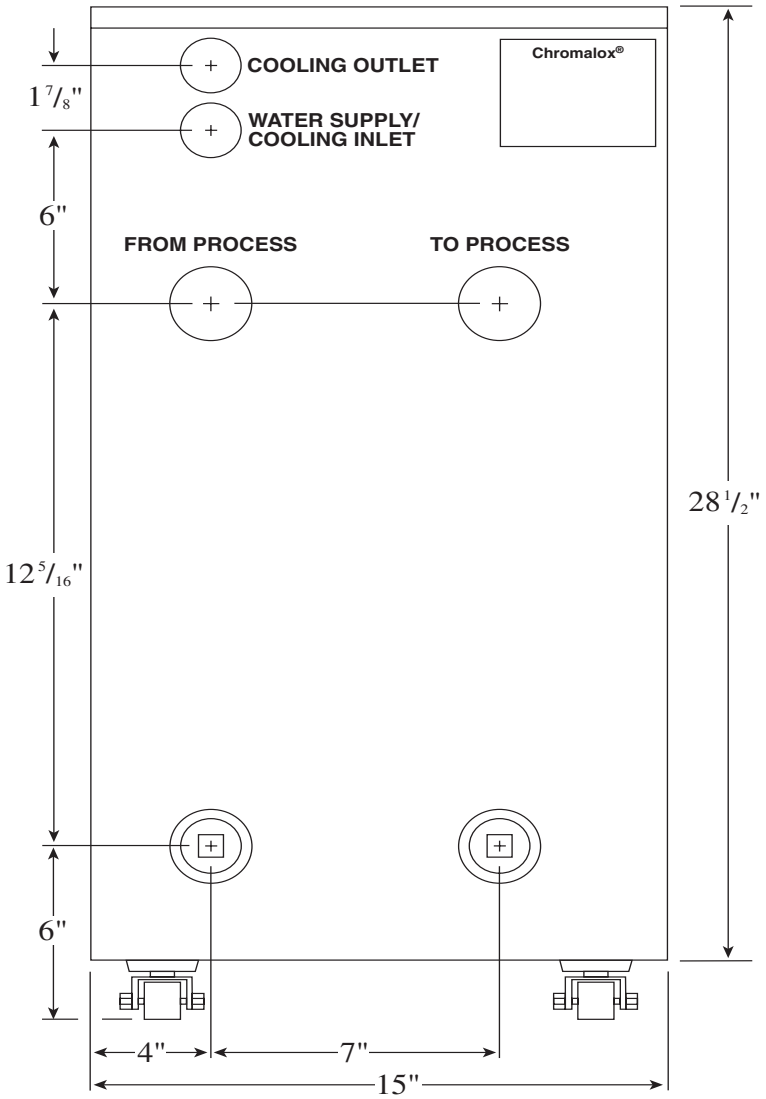
5. Connect the 1/4" NPT port identified as "COOLING OUTLET" to a cooling water return line or plant drain that contains no valves or obstructions that could impede discharge. Review the condition of potential hot water going down a plant drain. Verify that local codes and materials are acceptable for this service. Temperature of discharge water could reach 250°F and create steam at atmospheric pressure.

Figure 2.3
Closed-Loop System Piping



Closed Loop Cooling

Figure 2.4
Closed-Loop
Piping Connections



Rear View

Note: Dimensions are nominal ± 3/8”

Electrical Installation

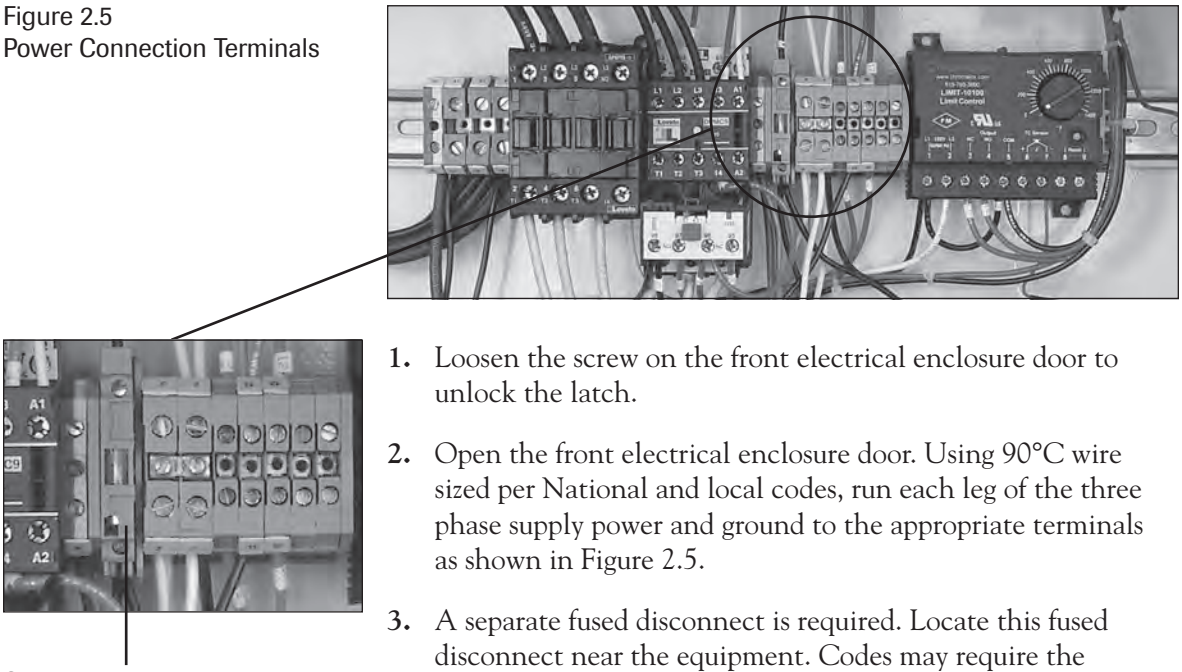
⚠ WARNING

1. **Hazard of electric shock.** The heat transfer system must be grounded using grounding means provided in control box and employing wiring by a qualified electrician in accordance with National Electric Code. Failure to comply can result in electrical shock or electrocution.
2. **Hazard of electric shock.** Disconnect all power before servicing the heat transfer system. Failure to comply can result in electrical shock or electrocution.

Fusing or other over-current protection must be supplied to the system by the user.

The unit is completely wired when shipped. The only wiring necessary is to the blue colored terminals L1, L2, L3, and the green-and-yellow colored ground. To make these connections:

Figure 2.5
Power Connection Terminals



1. Loosen the screw on the front electrical enclosure door to unlock the latch.
2. Open the front electrical enclosure door. Using 90°C wire sized per National and local codes, run each leg of the three phase supply power and ground to the appropriate terminals as shown in Figure 2.5.
3. A separate fused disconnect is required. Locate this fused disconnect near the equipment. Codes may require the location of disconnect in sight of operation standing next to the equipment. Consult applicable codes for details.

Pump Rotation Check

4. With power off, check the wiring connections by tugging on the lines. Tighten all terminals in the control area. These can loosen due to vibration in shipping.

5. Close the front electrical enclosure door. Pull the top cover off of the heat transfer system and locate the top of the pump motor.

6. With the supply water connected, and adequate pressure present, press the START and STOP buttons in quick succession. Watch the rotation on the pump motor to insure it matches the label on its top.

7. If rotation is incorrect, disconnect power to the system and swap any two of the supply lines. Repeat rotation check.

⚠ WARNING

Close the front electrical enclosure door and retighten the locking screw. This must be done to limit access to high voltage components. Failure to comply could lead to electric shock or electrocution.

Control Voltage Fusing

Terminal block #1 (see Figure 2.5) contains a 120V fuse for the control circuitry. this fuse protects the control transformer and circuitry.

1. Should the fuse blow, an indicator will light on the terminal block.

2. Disconnect power from the system.

3. Determine the cause of the blown fuse.

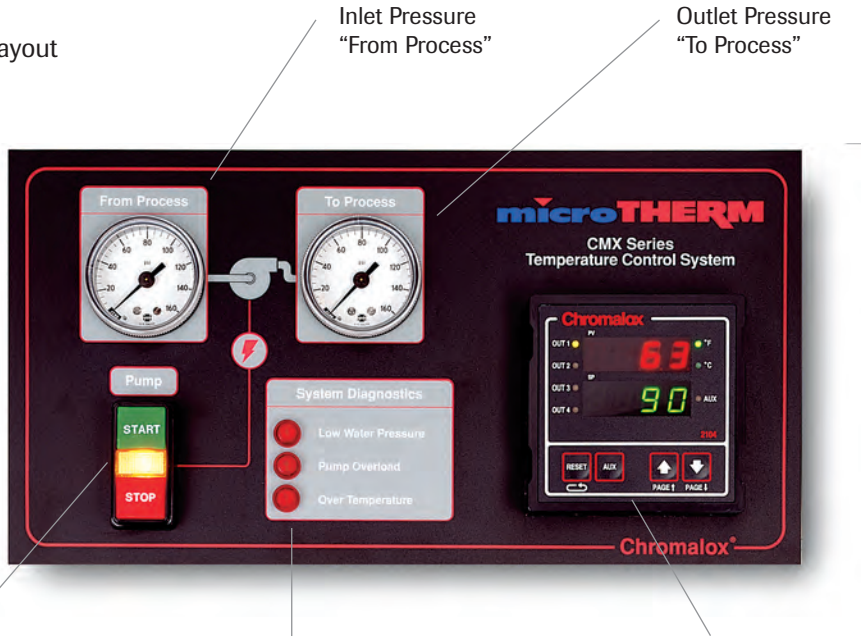
4. Replace with an equivalent fuse.

5. Reconnect power.

Section 3
Temperature Control Operations

- Control Panel
- Temperature Controller Operation

Figure 3.1
Control Panel Layout



START/STOP Pushbuttons

Press **START** to start the pump. Indicator will illuminate while pump is running. Press **STOP** to stop the pump.

Diagnostic Indicators

System shuts down if any diagnostic indicator is illuminated.

Low Water Pressure:
- System water pressure is below 20 psi. (Disabled on CMX-180 models)

Pump Overload:
- Pump has drawn too much current.

Over Temperature:
- System temperature has exceeded 260°F.

Temperature Controller

Top Display reads current system outlet temperature.

Bottom Display reads setpoint temperature.

Press ▲ to increase setpoint temperature.

Press ▼ to decrease setpoint temperature.

OUT 1
- Heat is being applied.

OUT 2
- Cooling is being applied.

OUT 3 and **OUT 4**
- Indicates overtemp condition

Press **RESET** to continue operation after overtemp.

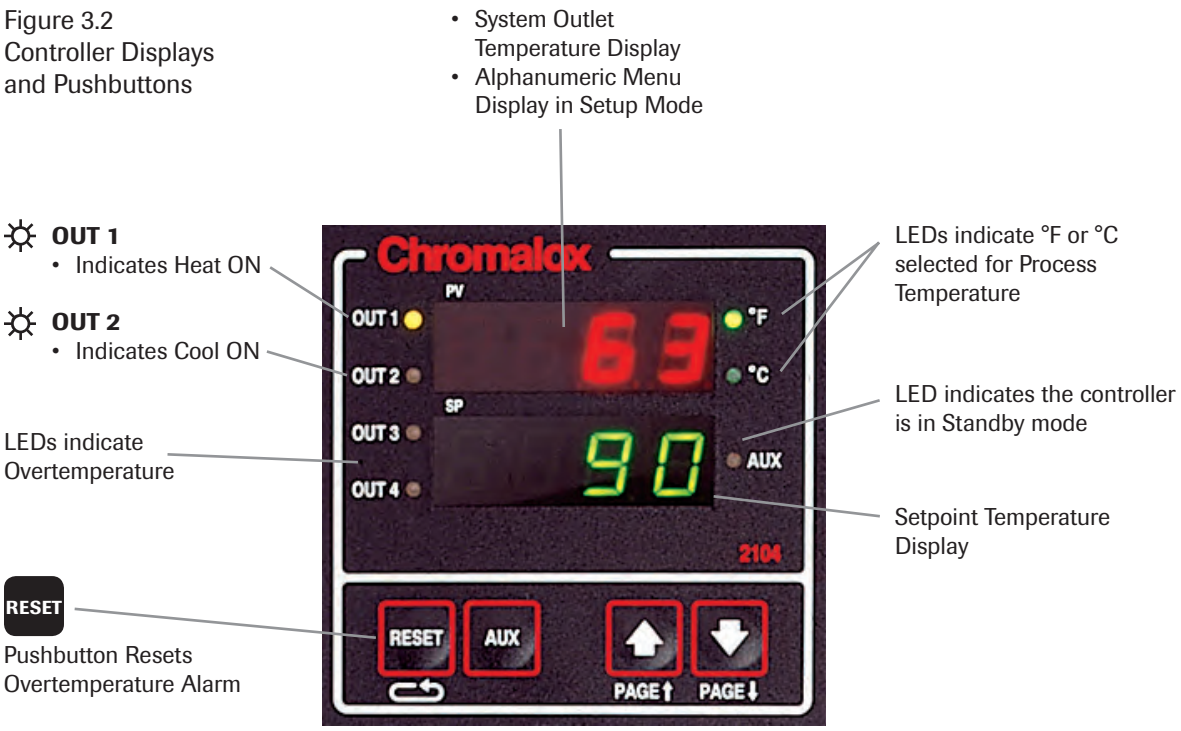
AUX
- Indicates system is in Standby.

Temperature Controller Operation

The Chromalox 2104 1/4 DIN temperature controller is a high-performance, single-loop controller used in the CMX system. The 2104 controller has two control outputs for heating and cooling that can be configured separately and provide flexible temperature control for the CMX. Additional outputs give the 2104 the ability to provide an over-temperature alarm. A dual digital display of current process temperature and setpoint temperature make the system easy to understand and operate.

The 2104 controller has extended capabilities and functions for more technically advanced applications. To learn more about how these controller capabilities may be used, consult the enclosed 2104 Controller Technical Manual, part number, 0037-75276.

Figure 3.2
Controller Displays and Pushbuttons



PAGE/MENU Setup

All control parameters, selections and calibration procedures for the temperature controller are accomplished through simple MENU selections. These MENU selections are organized into PAGES.

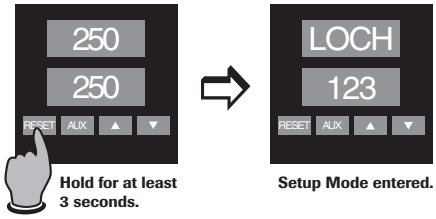
The Display PAGE (DISP) allows you to view the status of the controller. The Control Page (CTRL) allows you to change the control setpoint and security lock.

Figure 3.3 Controller PAGE/MENU Selections

Accessing the Security Lock or Setpoint MENU is accomplished by entering the Setup Mode, then selecting the Control PAGE and the desired MENU.

To enter Setup Mode:

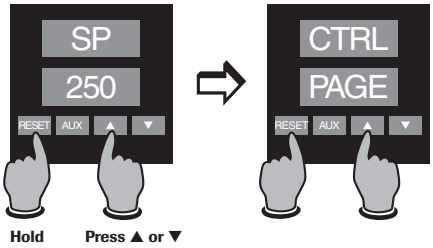
Hold down the RESET pushbutton for longer than 3 seconds.



To change the PAGE:

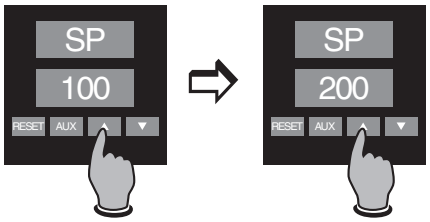
Press and hold the RESET pushbutton while pressing the ▲ or ▼ pushbutton. the upper display will increment (or decrement) through the PAGEs, and PAGE will be displayed in the lower display.

After reaching the CTRL PAGE, press RESET to move through the MENUs. The alpha cue for the MENU will appear on the upper display, and the current value will appear in the lower display.



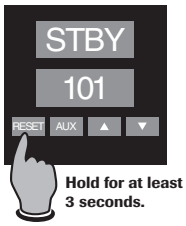
To change a MENU value:

After the MENU is selected and displayed, use the ▲ and ▼ pushbuttons to change the value. For large adjustments (for example, 100 to 200), hold the pushbutton pressed and the display will change more quickly.



To return to Operating Mode:

Press and hold RESET for more than 3 seconds. The controller will automatically return to operating mode after 10 minutes of no pushbutton activity.



Security Code

Every parameter or selection in the 2104 controller's setup PAGEs has an identifying MENU. The MENUs are accessible only if the correct Security Code is entered. This allows you to set the Security level that is apprpriate for your operating environment, prohibiting unauthorized access to or accidential changing of control parameters.

The microTHERM™ system is factory preset to security code 123. To adjust any of the controller's setup parameters, the security code must be set to 458.

The Security Code is entered on the Control PAGE CTRL, at the MENU LOCH. This code determines which MENUs may be adjusted.

To access and enter the Security Code:

1. Press and hold RESET for more than 3 seconds to enter Setup Mode. Security Lock is the first menu that will appear (LOCH).

2. To change the Security Code, press ▲ or ▼ until the correct security code is displayed (458 to change controller setup).

3. Reference the factory preset MENU settings (Figure 8.2, page 35), when replacing the controller or if the settings have been changed.

Control Page

Menu	Description	Available Settings	Factory Settings	Security
LOCH	Security Lock	0 to 9999	123	A
SP	Setpoint	Instrument sensor span	32°F	B

Alarm Relay Action

Output relays #3 and #4 are set as over-temperature latching alarms. If the microTHERM™ CMX system encounters an over-temperature condition (in excess of 260°F or 190°F on - CMX-180 models), both alarms will trip, disabling the system. Output #3 provides operator indication of an overtemp condition and Output #4 disables the system.

Do not change any of the settings for either output #3 or #4.

The system will not reset until the process temperature drops below the alarm value. The RESET pushbutton must be pressed and the temperature must be below 260°F (or 190°F on - CMX-180 models) in order to restart.

Notes

Section 4
System Operation

⚠ WARNING

On both open Closed-loop systems, turn on water and insure the water supply lines are free of obstructions **BEFORE** energizing the heater. Such obstructions could prevent the thermal expansion of water from backing up into this line, thereby increasing system pressure until the relief valve opens.

Note:
This system is equipped with an ASME safety pressure relief valve (factory preset at 125 psi or 150 psi with 7.5 hp motor).

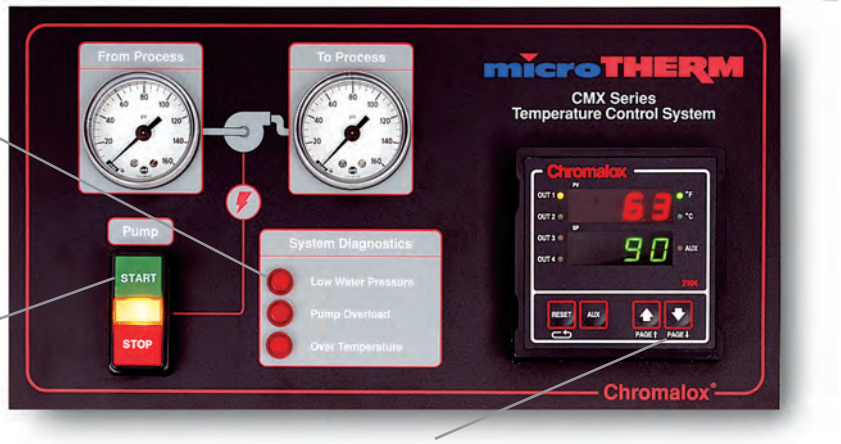
1. Apply power to the system via the remote disconnect. The temperature controller and "LOW WATER PRESSURE" diagnostics light should illuminate.

2. Open supply-water line and process valving to allow system to fill. Auto air bleed will remove air from the system. Any remote air bleed valves should be opened to remove air from process and associated piping.

3. "LOW WATER PRESSURE" diagnostic light should go out when the system is filled and has reached 20 psi. The system will not start when light is illuminated.

4. Adjust the temperature setpoint to the desired level via the controller front panel arrow keys (see page 15). For complete details on operation of temperature control, consult the separate 2104 Technical Manual (P/N 0037-75276) included with the unit.

Figure 4.1
System Operation



1. **Low Water Pressure Indicator** will light when power is first applied. Indicator will go out when system is filled and reaches 20 psi.

3. Press START to start the pump.

2. Adjust the temperature setpoint to desired level.

5. Assure that Pump Rotation Check was performed per instructions on page 12.

6. Start the pump by pressing START on the front panel. The pump indicator light will illuminate.

7. Once temperature has stabilized at the setpoint level, review controllability of the system. If the temperature (displayed in the top display of the temperature controller) is fluctuating at an unacceptable level, consult the temperature control instruction manual for details on tuning the controller. Heat and cooling action is indicated via the L.E.D.'s on the left side of the controller (OUT 1 for heat, OUT 2 for cooling).

8. If the system temperature is below the current setpoint, heat will be applied by the controller to the heater elements. If the temperature is above the setpoint, the cooling solenoid will open (open and closed loop) to reduce the system temperature.

⚠ WARNING

Operating systems at temperatures above 140°F will create surface temperatures on pipes that can cause burns. Precautions should be taken to prevent operator contact with hot pipes. Also, bleed valves should be locked down to prevent release of hot fluid.

☛ **Note:**
This is a PID type controller and cycling of the heat and cool can be expected below and above setpoint.

9. For system shutdown, lower the setpoint to 90°F or lower (see pages 15-17). Allow the system to cool to this temperature level.

10. Press STOP to de-energize the pump and disable the system.

11. Disconnect power to the unit.

⚠ WARNING

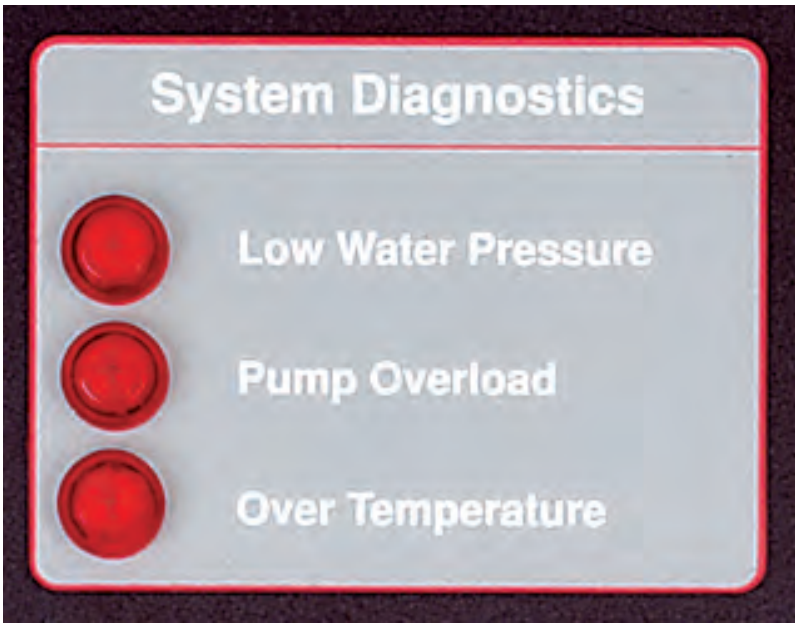
Do not leave system unattended in a **HOT** electrical condition; and do not leave system unattended in **HOT** environmental conditions.

Section 5
Diagnostics

Section Contents

- Lower Water Pressure
- Pump Overload
- Over Temperature

Figure 5.1
Diagnostic Indicators



Diagnostic Functions

All diagnostic functions will shut down the system and require the operator to remedy the problem before it can be restarted.

Low Water Pressure Indicators

The pump, heater, and cooling will not operate while the pressure is low. The Low Water Pressure Indicator will illuminate when the system pressure is below 20 psi. This warning system is designed to reduce the possibility of pump cavitation and boiling on the heater element at higher operating temperatures. Disabled on CMX-180 models.

Pump Overload Indicator

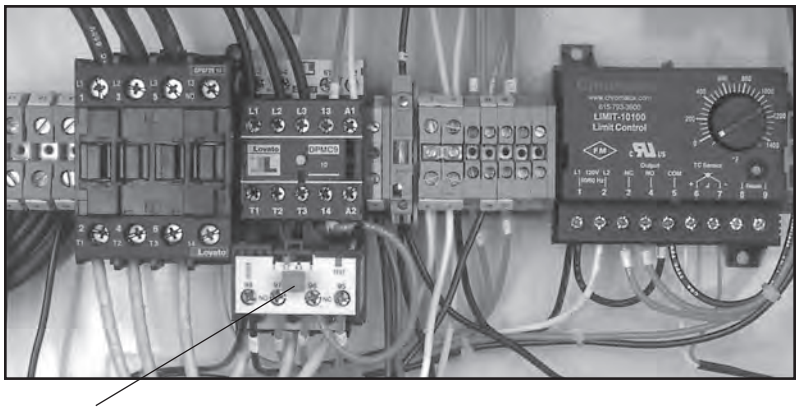
The Pump Overload Indicator will illuminate when the pump draws too much current. Low line voltage, single phase power input, and a seized pump motor are all possible causes for pump overload.

⚠ WARNING

Disconnect system power, if the Pump Overload Indicator is illuminated. Hazard of electric shock or electrocution. Disconnect all power and piping to the system.

After the system power is disconnected, solve the electrical current problem. To put the pump back on-line, open the front electrical enclosure and press the pump reset switch (See Figure 5.2, Overload Switch).

Figure 5.2
Pump Reset Switch



⚠ WARNING

Close the front electrical enclosure door and retighten the locking screw. This must be done to limit access to high voltage components. Failure to comply could lead to electric shock or electrocution.

Over Temperature Indicator

If the system temperature exceeds 260°F[1] (127°C), the Over Temperature Indicator will illuminate. When the system temperature drops below 260°F[1], press RESET on the controller face. The controller will not reset until the temperature is below 260°F[1].

[1] 190°F on CMX-180 model(s)

Section 6
Maintenance

Section Contents

- Shut Down
- Heater Removal/Replacement
- Pump Removal/Replacement
- Heat Exchanger Removal/Replacement (closed loop systems)

⚠ WARNING

Disconnect all power before servicing or performing maintenance to the system. Do not attempt to service system while it is operating.

Failure to comply can result in:

a. Electrical shock or electrocution.
b. Burns from hot heating elements, piping, and hot water.
c. Injury from operating or rotating pump and motor.

Maintenance is to be performed by qualified personnel only. Thoroughly read and understand these instructions. Consult the factory if you have any questions.

Shut Down

To take the unit out of service, the following steps must be done in sequence:

1. Set the temperature controller setpoint to 90°F or lower. Allow to cool.
2. Turn off power to the unit. The controller will turn off.
3. Turn off the water supply to the unit.
4. Disconnect electrical supply to the unit.
5. Carefully bleed pressure from the system by loosening a pipe fitting.

⚠ WARNING

System may be pressurized. Use extreme care while removing piping. Disconnect water supply, drain and process connections.

6. Drain all water from the system.

Draining

Drain the unit before taking it out of service for a period of time, or if it is exposed to freezing temperatures while out of service.

1. To drain the unit completely, move it to an inclined position with the front of the system raised.
2. Remove the lower plugs on cast chambers (see Figure 6.1, Chamber Photo).

Figure 6.1
Chamber Photo

Heater Removal/ Replacement

⚠ WARNING

Hazard of electric shock or electrocution. Disconnect all power and piping to system.

1. Disconnect all power to the system.
2. Bleed pressure and drain all water from the system.
3. Remove top panel.
4. Remove red top cover on the heater (see Figure 6.2, Heater/Chamber Photo).
5. Note location of wires on the heater, then remove wires (L1, L2, L3).
6. Loosen compression fitting on the heater power supply cable.
7. Remove cable from the heater.
8. Unbolt the heater (4 bolts) and remove.
9. Remove bussing from old heater and re-install on replacement heater, using the same orientation
10. Replace heater and reverse procedure.

⚠ WARNING

Close the front electrical enclosure door and retighten the locking screw. This must be done to limit access to high voltage components. Failure to comply could lead to electric shock or electrocution.

Figure 6.2
Heater/Chamber Photo

⚠ WARNING

Hazard of electric shock or electrocution. Disconnect all power and piping to system.

Pump Removal/Replacement

1. Disconnect all power to the system.
2. Bleed pressure and drain all water from the system.
3. Remove top and side panels.
4. Remove pump motor wiring cover panel (2 screws).
5. Note location of pump motor wires and remove.
6. Loosen and remove vent line (see Figure 6.3, Motor Vent Line).
7. Remove bolts holding pump motor to the casting (4 bolts), and lift motor out of casting.
8. Remove impeller and install new mechanical seal and impeller on the new motor.
9. Place new motor in system and bolt down.
10. Replace vent line and tighten.
11. Reconnect wires and replace wiring cover and side panels.
12. Reconnect the system.
13. Perform Pump Rotation Check (see Section 2, page 12).
14. Replace top panel.

⚠ WARNING

Close the front electrical enclosure door and retighten the locking screw. This must be done to limit access to high voltage components. Failure to comply could lead to electric shock or electrocution.

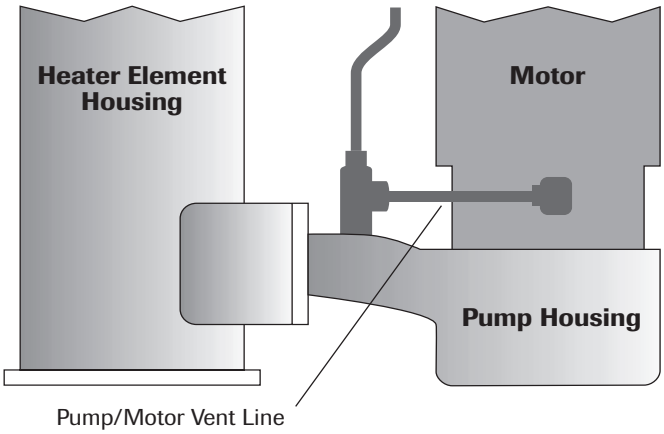


Figure 6.3
Motor Vent Line

Heat Exchanger Removal/Replacement (Closed loop system)

1. Disconnect all power to the system.
2. Bleed pressure and drain all water from the system.
3. Remove top panel.
4. Remove cover on the cooling solenoid (see Figure 6.4, Heat Exchanger).
5. Disconnect "COOLING INLET" and "COOLING OUTLET" piping.
6. Disconnect copper tubing connected to the heat exchanger.
7. Unbolt the heat exchanger and remove (4 bolts).
8. Place new heat exchanger in system and bolt down.
9. Reconnect "COOLING INLET" and "COOLING OUTLET" piping.
10. Reconnect wires to the cooling solenoid.
11. Reconnect copper tubing.
12. Replace cover on cooling solenoid and top panel.
13. Replace system water and reconnect the system.

⚠ WARNING

Close the front electrical enclosure door and retighten the locking screw. This must be done to limit access to high voltage components. Failure to comply could lead to electric shock or electrocution

Figure 6.4
Heat Exchanger

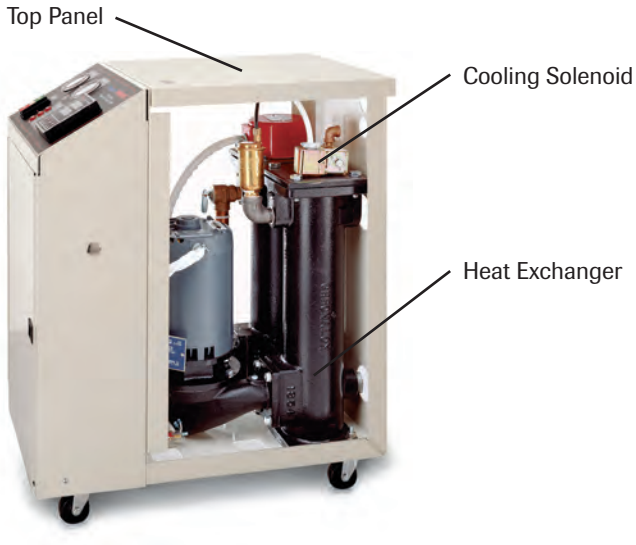
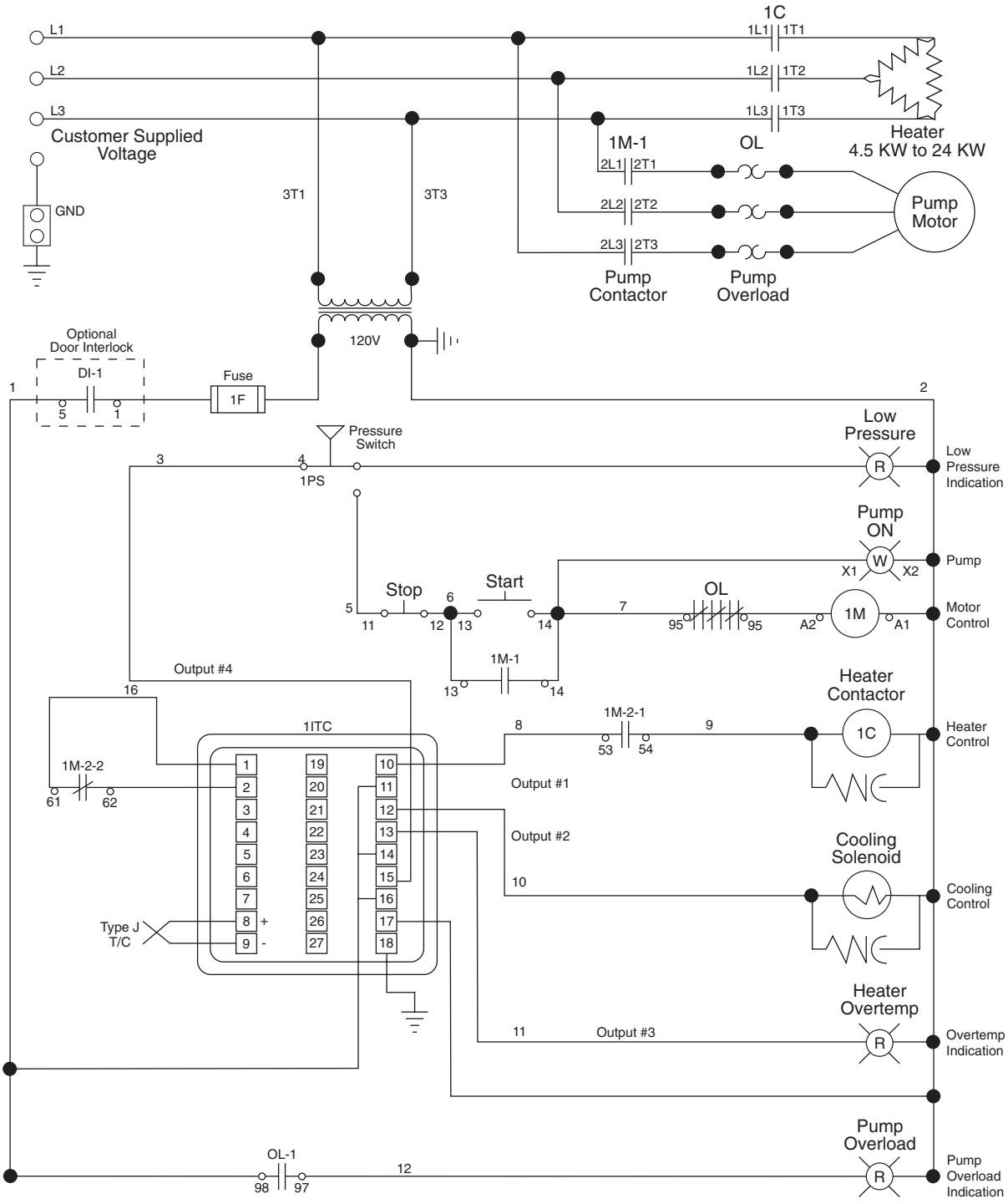


Figure 6.5
microTHERM™ Open and Closed-Loop Electrical Schematic



Replacement Heating Elements and Contactors

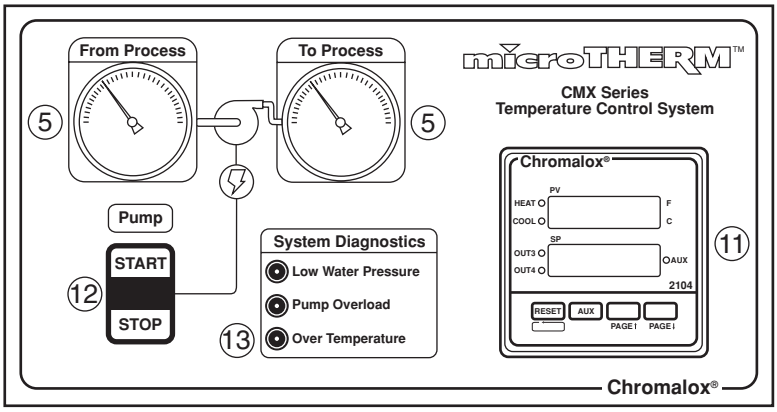
microTHERM™ Model			Replacement Parts	
Open Loop	**Closed Loop**	**Voltage**	**Heating Element**	**Heater Contactor**
CMX-4	CMX-4C	240 480	155-554807-523 155-554807-523	072-057576-050 072-057576-050
CMX-9	CMX-9C	240 480	155-554807-512 155-554807-512	072-057576-050 072-057576-050
CMX-12	CMX-12C	240 480	155-554807-524 155-554807-524	072-057576-050 072-057576-050
CMX-18	CMX-18C	240 480	155-554807-519 155-554807-519	072-057576-051 072-057576-050
CMX-24	CMX-24C	240 480	155-554807-515 155-554807-515	072-057576-051 072-057576-050

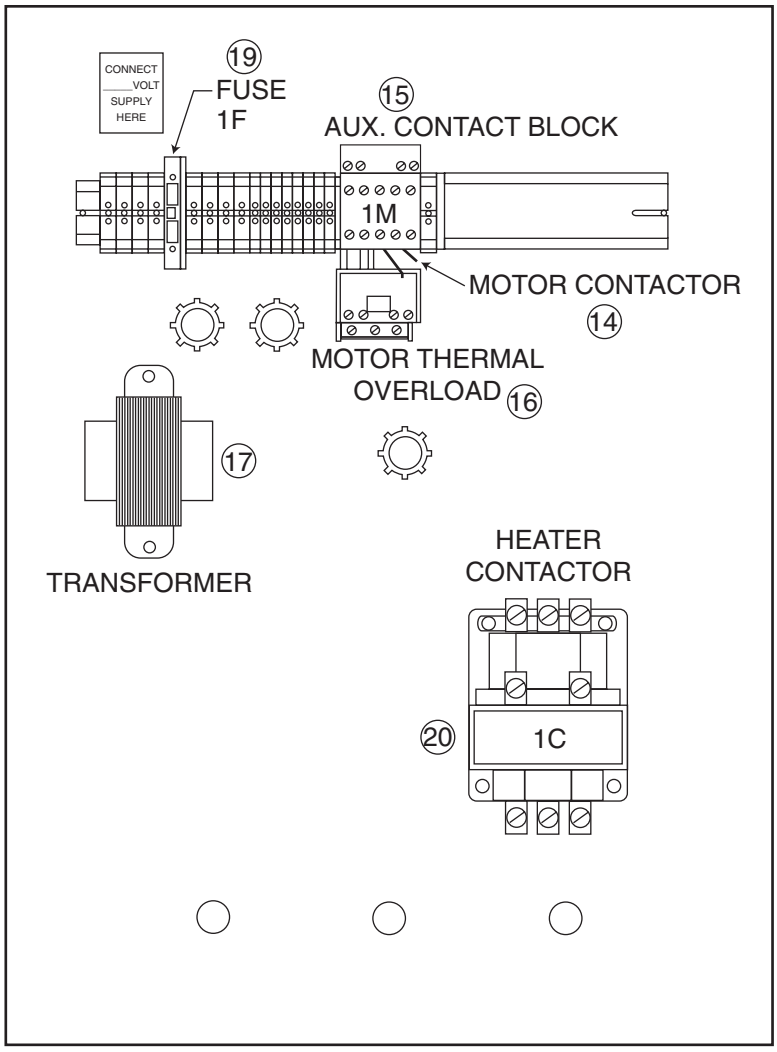
Replacement Parts Common to Most Models

Identification #	Part Name	Part #
* 1	3/4 HP Motor 240V/480V	193-121843-227
2	Solenoid Valve	344-121780-012
3	Pressure Relief Valve	344-048419-004
4	Automatic Air vent	344-053181-001
5	Pressure Gauge	130-118661-021
6	Pressure Switch	292-121927-028
* 7	Pump Mechanical Seal	251-121946-019
8	Heat Exchanger Bundle (Closed Loop)	353-123367-002
9	Heater/Cooling Gasket (2 total)	132-146012-020
10	Thermocouple	309-121759-063
* 11	Temperature Controller	300-123617-001
12	Switch, Start/Stop	292-122882-043
12	Switch Indicator Bulb	213-122066-034
13	Diagnostic Indicator Light (3 total)	213-122066-041
14	Motor Contactor 240/480V	072-123534-064
15	Auxillary Motor Contact Block	071-122886-055
* 16	Motor Thermal Overload 240V	359-122078-096
* 16	Motor Thermal Overload 480V	359-122078-095
17	Transformer 240/480V	315-303786-001
18	Caster (4 total)	375-123425-003
19	Control Voltage Fuse	128-123445-005
20	Heater Contactor	See table above

* These parts may vary for non-catalog items. Please consult your local Chromalox representative. (800-443-2640 or www.chromalox.com)

Figure 6.6
Replacement Parts
Identification





Section 7
Troubleshooting

Troubleshooting Guide—*For qualified personnel only*

Symptom	Probable Cause	Correction
Unit will not start, control display does not light.	1. Unit not wired correctly.	1. Check wiring.
	2. Disconnect switch OFF.	2. Turn disconnect ON.
	3. Blown fuse.	3. Check disconnect fuses and 120V fuse on terminal block (blown fuse indicator will light if fuse is blown).
	4. Wrong voltage.	4. Check supply voltage and unit's rated voltage.
Control display lights, unit will not start.	1. Cooling water off, or below 20 psi. (CMX-250 models only)	1. Open cooling water valve, check to assure pressure is above 30 psi.
	2. Pump motor overload.	2. Determine problem and press pump reset.
	3. System above temperature limit of 260°F. (190°F on CMX-180 models)	3. Allow unit to cool below 260°F and press RESET.
Unit stops while running.	1. Cooling water drops below 20 psi.	1. Check cooling water valve, check to assure above 30 psi.
	2. Pump motor overload.	2. Determine problem, press pump reset, and restart.
	3. System exceeds temperature limit of 260°F. (190°F on CMX-180 models)	3. Allow unit to cool below 260°F, press RESET, and restart.
Low Water Pressure Indicator illuminated.	1. Cooling water below 20 psi. (CMX-250 models only)	1. Check that pressure is above 30 psi.

continued ➔

Troubleshooting Guide—*For qualified personnel only*

Symptom	Probable Cause	Correction
Pump Overload Indicator illuminated.	1. Pump motor overload.	1. Determine problem and press pump reset button.
Over Temperature Indicator illuminated	1. System above temperature limit of 260°F. (190°F on CMX-180 models)	1. Allow unit to cool below 260°F and press RESET.
Unit runs but fails to pump water.	1. Incoming phase reversed on pump motor.	1. Swap any two legs on the incoming power.
Unit will not heat to setpoint.	1. Cooling valve stuck open.	1. Check for cooling water flow during heat cycle.
	2. Heater element failure.	2. Check current at heater contactor during heating.
	3. Heater output insufficient.	3. Excessive losses in process or incorrectly sized unit for application.
	4. Controller needs to be tuned.	4. Check factory MENU settings, page 35 of this manual. Refer to 2104 Controller Technical Manual, page 35, for further information.
Unit will not cool to setpoint.	1. Inadequate cooling water flow.	1. Open cooling water supply line more and assure adequate pressure.
	2. Cooling outlet obstructed.	2. Check cooling outlet for obstructions.
	3. Heater contactor fused closed.	3. Check voltage across contactor during cooling cycle.
	4. Controller needs to be tuned.	4. Check factory MENU settings, page 35 of this manual. Refer to 2104 Controller Technical manual, page 35, for further information.

If you continue to have problems with the system after review of the above issues, please contact Chromalox Product Service at 866-736-6686 from 9 A.M. to 5 P.M. EST.

Section 8
Specifications

Standard 3/4 HP Pump

Pump Size (HP)	Nominal Flow (gpm)	Heating Capacity (kW)	Standard Voltages	Process Connections (inches dia.)	Drain/supply (inches dia.)	Approximate Dimensions (inches)
		4.5	240 or 480			
		9	240 or 480			29 height
3/4	30	12	240 or 480	1 1/4 NPT	1/4 NPT	25 depth
		18	240 or 480			15 width
		24	240 or 480			

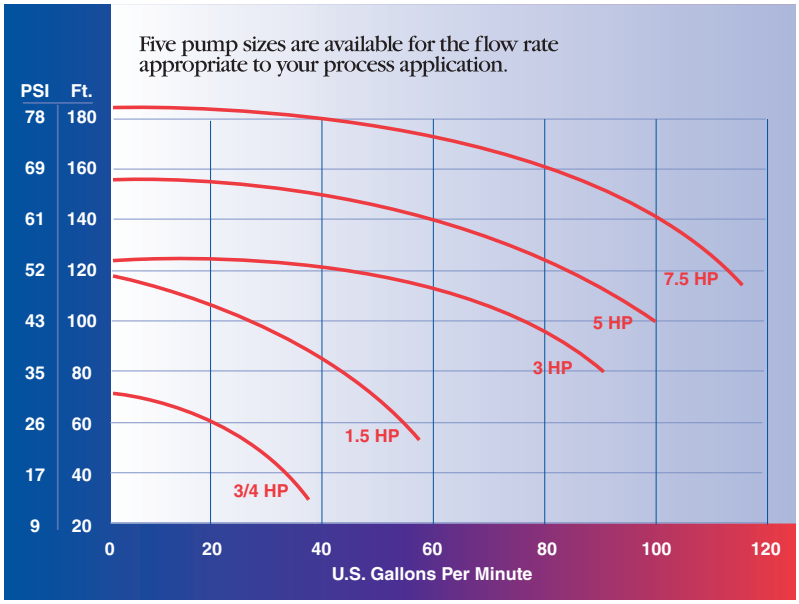
Optional Pump Sizes

Optional Pump Sizes (HP)	Nominal Flow (gpm)
1.5	40
3	50
5	60
7.5	80

Other Options

- Alternate Voltages: 208, 380, 575 VAC, 3 phase
- Expanded Open Loop Cooling: increased cooling water flow
- Expanded Closed Loop Cooling: 6.3 sq. ft. heat exchanger
- Solid State Power Control: SCR heater switching
- Surge Reduction valve: reduces water pressure spikes
- Door Interlock: prevents operation with service door open
- Digital Communications: for interface with ChromaSoft or remote PC/PLC systems
- IEC Style Contactor: for dry contact power switching
- Isolation Valve Kit: 1" ball valve for system isolation

figure 8.1
Pump Capacity



Pump Capacity

Figure 8.2 Controller MENU settings

	UPPER DISPLAY	LOWER DISPLAY FACTORY SETTINGS	LOWER DISPLAY CHANGE TO
CONTROL SETUP PAGE	CtrI		
SECURITY CODE	LocH	458	123 ** SEE NOTE 1 BEFORE CHANGING **
SET POINT	SP	-100˚F	
AUXILIARY SET POINT	AuSP	-100˚F	
SELF TUNING	tunE	OFF	
PROPORTIONAL BAND 1	Pb 1	25˚F	15˚F
AUTOMATIC RESET 1	Ar 1	0.1	
RATE 1	rAt 1	10 secs	20 secs
DEAD BAND 1	db 1	5˚F	
PROPORTIONAL BAND 2	Pb2	25˚F	10˚F
AUTOMATIC RESET 2	Ar2	0.1	0.0
RATE 2	rAt2	10 secs	0 secs
DEAD BAND 2	db2	5˚F	
MANUAL RESET	OFSt	0	
FUZZY LOGIC	FL	On	
OPEN SENSOR OUTPUT	Orng	0.0 %	
LOOP ERROR TIMER	LooP	OFF	
AUTO/MANUAL DISINTEGRATION TIME	Auto	10 secs	
RAMP RATE	rrAt	OFF	
CONTROLLER TYPE	Cont	HEAt	HtCl
COOLING MEDIUM	CooL	Pid2	
REMOTE SETPOINT	rSP	OFF	
EVENT INPUT FUNCTION	Ent1	nonE	Outd
AUXILIARY KEY FUNCTION	Au	nonE	
ANALOG OUTPUT ASSIGNMENT	Aout	ASP	
RAMP/SOAK ENABLE	rSEn	OFF	
USER SECURITY CODE	CodE	0	
INPUT PAGE	InPt		
SENSOR INPUT SELECTION	SEnS	J	
DISPLAY UNITS	unit	F	
CAL OFFSET	CoFF	0˚F	
PROCESS SETPOINT LOWER LIMIT	SPLL	-100˚F	32˚F
PROCESS SETPOINT UPPER LIMIT	SPUL	2100˚F	250˚F

	UPPER DISPLAY	LOWER DISPLAY FACTORY SETTINGS	LOWER DISPLAY CHANGE TO
OUTPUT 1	Out 1		
OUTPUT 1 CYCLE TIME	Cyc 1	1.0 secs	10.0 secs
OUTPUT LIMIT	OL 1	100.0 %	
HEAT OFFSET	HoFF	0˚F	
OUTPUT 2	Out2		
OUTPUT 2 CYCLE TIME	Cyc2	1.0 secs	5.0 secs
OUTPUT LIMIT	OL2	100.0 %	
COOL OFFSET	CoFF	0˚F	
OUTPUT 3	Out3		
OUTPUT TYPE	tyP3	OFF	ALr
ALARM TYPE	AI r3	nonE	Hi
ALARM RELAY	rLy3	ndE	ndEL
ALARM LOW SET POINT	ALo3	-100˚F	
ALARM HIGH SET POINT	AHi 3	2100˚F	260˚F
DEADBAND (HYSTERESIS)	db3	1˚F	
ALARM INHIBIT	inh3	OFF	
OUTPUT 4	Out4		
OUTPUT TYPE	tyP4	OFF	ALr
ALARM TYPE	AI r4	nonE	Hi
ALARM RELAY	rLy4	ndE	nEL
ALARM LOW SET POINT	ALo4	-100˚F	
ALARM HIGH SET POINT	AHi 4	2100˚F	260˚F
DEADBAND (HYSTERESIS)	db4	1˚F	
ALARM INHIBIT	inh4	OFF	

NOTE:

1. CHANGE SECURITY CODE AFTER ALL OTHER CHANGES HAVE BEEN MADE
2. CHECK ALL LISTED VALUES, EVEN IF NO CHANGE IS INDICATED

Notes

Section 9
CMX Warranty and Limitation of Remedy and Liability

Warranty

Chromalox warrants only that the Products and parts manufactured by Chromalox, when shipped, and the work performed by Chromalox when performed, will meet all applicable specification and other specific product and work requirements (including those of performance), if any, and will be free from defects in material and workmanship under normal conditions of use. All claims for defective or nonconforming (both hereinafter called defective.) Products, parts or work under this warranty must be made in writing immediately upon discovery, and in any event, within one (1) year from delivery, provided, however all claims for defective Products and parts must be made in writing no later than eighteen (18) months after shipment by Chromalox. The temperature controller, heater and pump/chamber casting warranty is extended to three (3) years from date of shipment. Defective and nonconforming items must be held for Chromalox's inspections and returned to the original f.o.b. point upon request. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Liability

Notwithstanding the provisions of this WARRANTY AND LIMITATION Clause, it is specifically understood that Products and parts not manufactured and work not performed by Chromalox are warranted only to the extent and in the manner that the same are warranted to Chromalox by Chromalox's vendors, and then only to the extent that Chromalox is reasonably able to enforce such warranty, it being understood Chromalox shall have no obligation to initiate litigation unless Buyer undertakes to pay all cost and expenses therefore, including but not limited to attorney's fees, and indemnifies Chromalox against any liability to Chromalox's vendors arising out of such litigation.

Limitation of Remedy

Upon Buyer's submission of a claim as provided above and its substantiation, Chromalox shall at its option either (i) repair or replace its Products, parts or work at the original f.o.b. point of delivery or (ii) refund an equitable portion of the purchase price.

THE FOREGOING IS CHROMALOX'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY, AND IS BUYER'S EXCLUSIVE REMEDY AGAINST CHROMALOX FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES, BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTIAL OR CONSEQUENTIAL DAMAGES AND BUYER SHALL HOLD CHROMALOX HARMLESS THEREFROM. ANY ACTION BY BUYER ARISING HEREUNDER OR RELATING HERETO, WHETHER BASED ON BREACH OF CONTACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE DATE OF SHIPMENT OR IT SHALL BE BARRED.

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Appendix A

General Instruction

All warnings and cautions denoted throughout this user's manual also apply to the CMX-180 model. General instructions and specifications referring to the CMX-250 also apply to the CMX-180 with specific differences outlined below.

Low Pressure Application

The CMX-180 is designed to operate at pressures below 20 psi and temperatures up to 180°F. It is constructed with the same quality components as the CMX-250, but the pressure switch is not provided. This allows the pump to operate in low pressure applications. The Low Water Pressure indicating light on the control panel is disabled.

Element Over-Temperature Cutout

A cutout in the heater housing protects the elemnts from damage due to over-temperature. The over-temperature cutout will shut the system off if the heaters are not completely immersed in water.

Diagnostic Indicator
Page reference: 13, 22

Over Temperature indicator is illuminated:
System temperature has exceeded 190°F (instead of 260°F).

Alarm Relay Action
Page Reference: 17

Replace 260°F with 190°F.

Controller 2104 Menu

Refer to Section 8:Specifications, Fig. 8.2: Controller Menu Settings

	Upper Display	Lower Display Factory Settings	Lower Display Change to
INPUT PAGE			
Process Setpoint Upper Limit	SPUL	2100˚F	180˚F
OUTPUT 3			
Alarm High Setpoint	AH:3	2100˚F	210˚F
OUTPUT 4			
Alarm High Setpoint	AH:4	2100˚F	210˚F

Trouble Shooting

Trouble Shooting Guide
Page Reference: 31, 32

Replaces 260°F with 190°F.

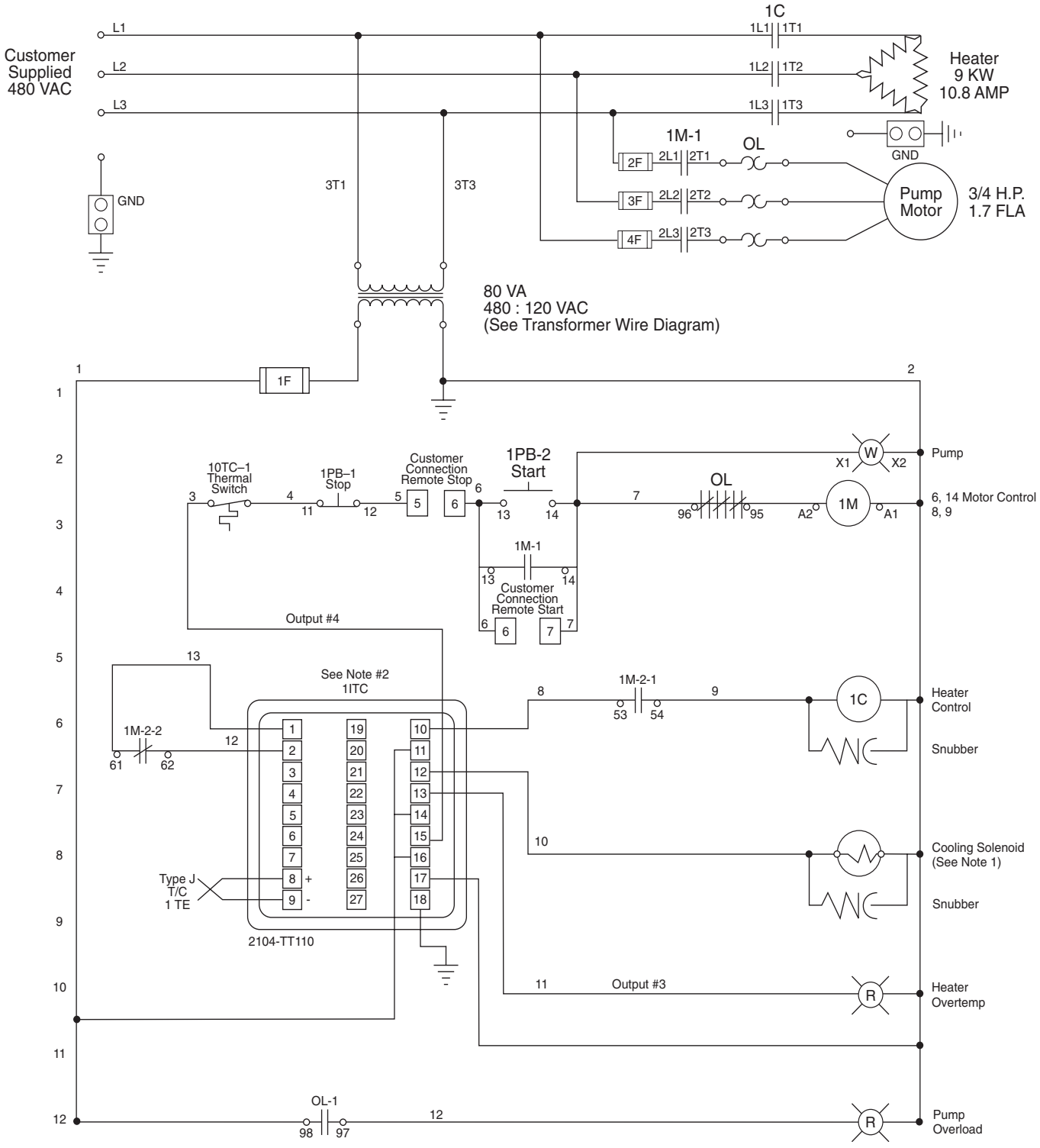
Unit stops running but temperature indicator light is not illuminated.	Probable Cause	Correction
	Heating element not immersed—no flow.	Allow unit to cool. Check that the element is immersed and flow is adequate.

Replacement Parts

Page reference: 29
Additional part

Identification #	Part Name	Part #
21	Over-temperature cutout	300-012172-008

Appendix A
microTHERM™: CMX-180 Open and Closed-loop Electrical Schematic



Appendix B
microTHERM™: CMX Closed Loop to Open Loop Cooling Conversion

Note: *All warnings and cautions denoted throughout this user's manual also apply to the modifications listed below. General instructions and specifications referring to the open and closed loop systems apply to the field-modified units below.*

This sheet details the steps taken and material required to convert a Chromalox CMX microTHERM hot water system from closed loop cooling to open loop cooling. The basic operation involves removing the heat exchanger bundle and replacing it with a flat plate. Please contact the Chromalox Customer Service department for more information and to order the necessary materials.

New Material Required

1. 1/4" NPT Pipe Plug	1 piece	Chromalox part number 218-075439-036
2. 1/4" NPT x 1-1/2" Nipple	1 piece	Chromalox part number 198-122817-013
3. 1/4" NPT Elbow	1 piece	Chromalox part number 107-122815-001
4. 1/4" NPT Close Nipple	1 piece	Chromalox part number 198-122817-002
5. 1x1/2" NPT Reducer	1 piece	Chromalox part number 032-120942-019
6. Open loop cooling flange	1 piece	Chromalox part number 121-510702-017

Replacement Steps

Figures 1 and 2 show the layout of the cooling configuration for both closed and open loop cooling. These parts are located on the top of the cooling chamber. Use pipe tape or other sealing compound when attaching threaded connections.

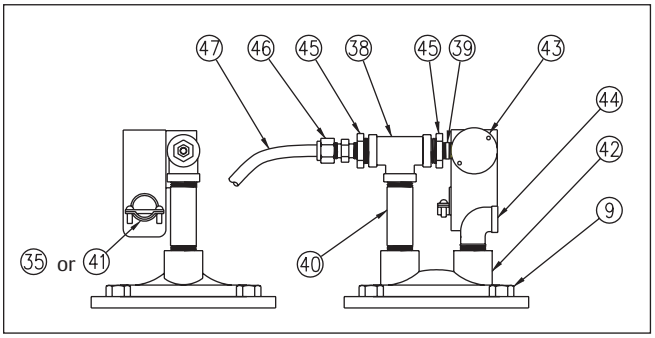


Figure 1: Closed Loop Cooling

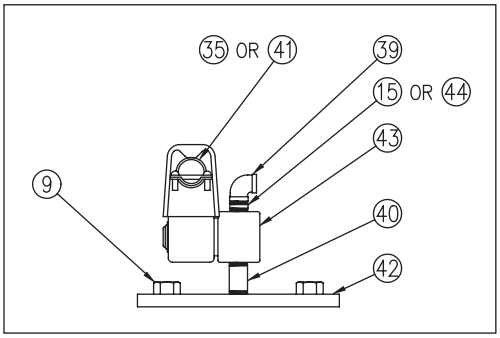


Figure 2: Open Loop Cooling

Note: Refer to Figures 3 and 4 for location of components.

1. Remove (47) 3/8" copper tube and compression fittings from heat exchanger and tee above pump inlet.
2. Place 1/4" pipe plug into tee above pump inlet where copper tube was connected.
3. Pop magnetic coil from top of (43) solenoid valve and leave wired to system.
4. Remove (43) solenoid valve from top of heat exchanger and keep for reinstallation.
5. Remove four (9) bolts and lift (42) heat exchanger from cooling chamber.
6. Reuse rubber gasket and (9) bolts to attach new (42) cooling flange to cooling chamber.
7. Attach new (40) 1-1/2" nipple to flange.
8. Attach (43) solenoid and magnetic coil to nipple.
9. Attach new (15) close nipple and new (39) elbow to solenoid.
10. Replace 1" pipe plug from lower cooling chamber port with 1 x 1/2" reducer.
11. Lower cooling chamber port becomes the new cooling inlet.

Appendix C
microTHERM™: CMX Open Loop to Closed Loop Cooling Conversion

Note: *All warnings and cautions denoted throughout this user's manual also apply to the modifications listed below. General instructions and specifications referring to the open and closed loop systems apply to the field-modified units below.*

This sheet details the steps taken and material required to convert a Chromalox CMX microTHERM hot water system from open loop cooling to closed loop cooling. The basic operation involves removing the flat plate and replacing it with a heat exchanger bundle. Please contact the Chromalox Customer Service department (1-800-368-2493) for more information and to order the necessary materials.

New Material Required

1.	1/4" NPT Tee	1 piece	Chromalox part number 299-122818-001
2.	1/2" NPT Tee	1 piece	Chromalox part number 299-122818-003
3.	1/4" NPT x 7/8" Nipple	1 piece	Chromalox part number 198-122817-002
4.	1/2" NPT x 3" Nipple	1 piece	Chromalox part number 198-122817-090
5.	1/2" NPT Street Elbow	1 piece	Chromalox part number 107-114567-005
6.	Bush Reducer 1/2" x 1/4"NPT	2 pieces	Chromalox part number 032-121003-005
7.	Compression Fitting, 1/4" NPT x 3/8" tube	2 pieces	Chromalox part number 119-114570-001
8.	Tubing 3/8" copper	2 Feet	Chromalox part number 318-511965-001
9.	Gasket	1 piece	Chromalox part number 132-146012-020
10.	Heat Exchanger Tube Bundle	1 piece	Chromalox part number 353-123367-002
11.	1" NPT Pipe Plug	1 piece	Chromalox part number 218-075439-066
12.	Labels	1 piece	Chromalox part number 170-122103-040

Replacement Steps

Figures 1, 2, 3 and 4 show the layout of the cooling configuration for both closed and open loop cooling. These parts are located on the top of the cooling chamber and the pump inlet. Use pipe tape or other sealing compound when attaching threaded connections.

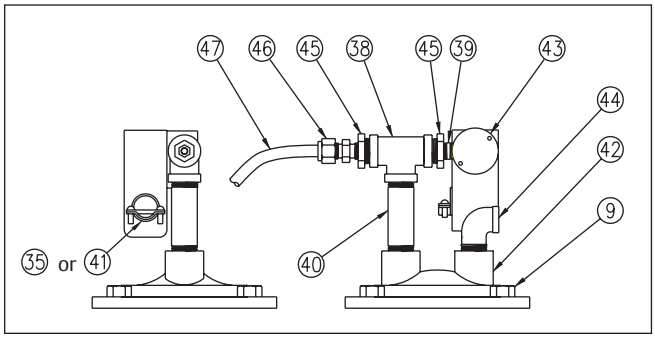


Figure 1: Closed Loop Cooling

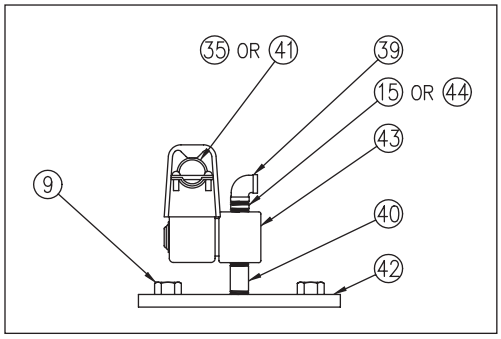


Figure 2: Open Loop Cooling

Note: Refer to Figures 3 and 4 for location of components.

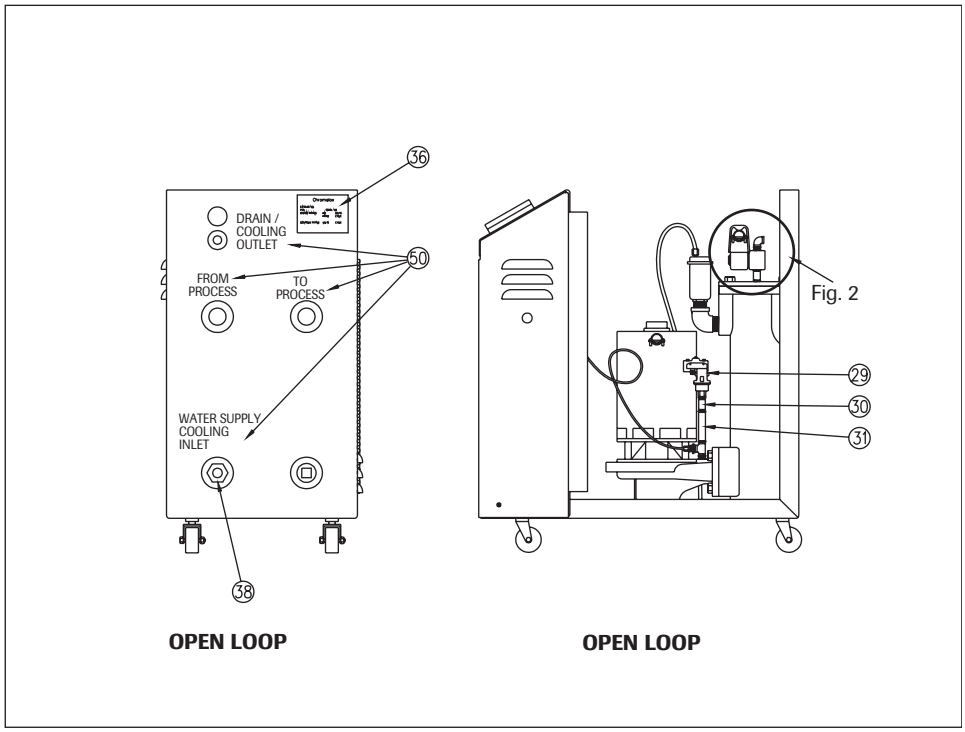


Figure 3: Open Loop Cooling

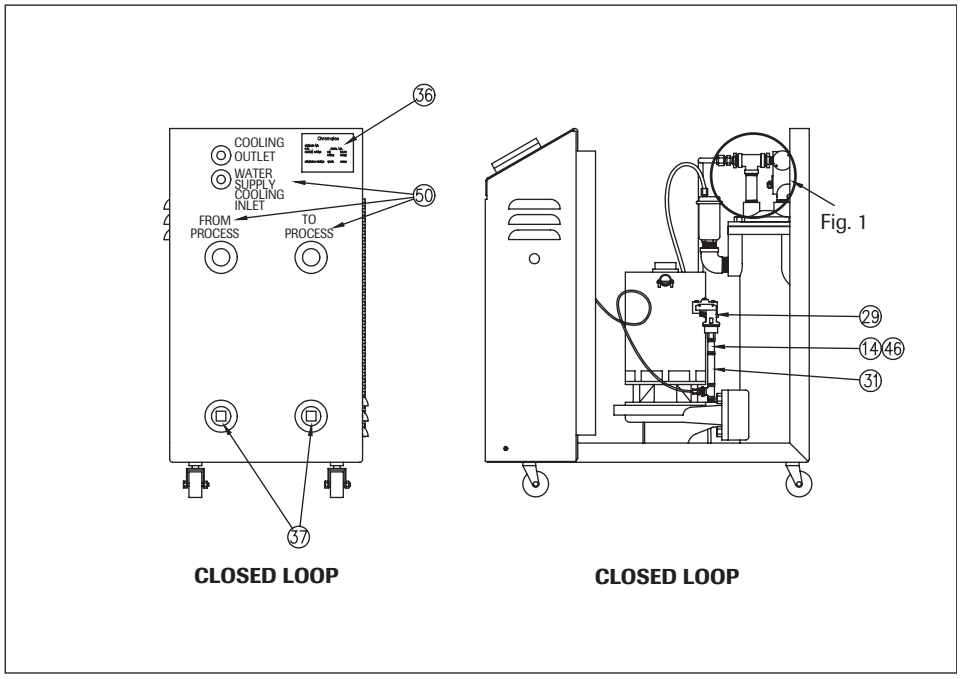


Figure 4: Closed Loop Cooling

Installation Steps

1. Drain fluid from system and disconnect all power.
2. **Fig. 2**: Remove 1/4" NPT elbow (39), nipple (15) and nipple (40) from solenoid valve and keep solenoid valve for reinstallation.
3. **Fig. 2**: Remove flange (42).
4. **Fig. 3**: Remove 1/4" coupling (30) from pump inlet nipple (31) and remove coupling from pressure switch (29). Keep pressure switch for reinstallation.
5. **Fig. 4**: Install 1/4" NPT tee (14) on pump inlet nipple (31), install compression fitting (46) in 1/4" NPT tee (14). Reinstall pressure switch (29) into top of 1/4" NPT tee (14).
6. **Fig. 1**: Install heat exchanger (42) using new gasket and existing bolts.
7. **Fig. 1**: Install the following items onto the heat exchanger:
   - 1/2" NPT street elbow (44)
   - 1/2" NPT x 3" nipple (40)
   - 1/2" NPT tee (38)
   - 1/2" x 1/4" NPT bush reducers (45)
   - 1/4" NPT x 7/8" nipple (39)
   - compression fitting (46)
   - solenoid valve (43) removed earlier
8. **Fig. 1**: Install 3/8" copper tubing (47) in compression fitting (46). Route tubing to compression fitting (46) near pump inlet shown in **Fig. 4**. Do not kink tubing.
9. **Fig. 3**: Remove the 1" x 1/2" NPT bush reducer (38) from the bottom port on the inlet chamber.
10. **Fig. 4**: Install 1" NPT pipe plug (37) in bottom port of the inlet chamber.
11. **Fig. 3**: Remove the following labels from the CMX back panel:
    - "Water Supply / Cooling Inlet" from bottom port on inlet chamber
    - "Drain / Cooling Outlet" from bottom heat exchanger opening
12. **Fig. 4**: Apply new labels (50) to CMX back panel:
    - "Cooling Outlet" to top heat exchanger opening.
    - "Water Supply / Cooling Inlet" to bottom heat exchanger opening.
13. Test all connections for leaks